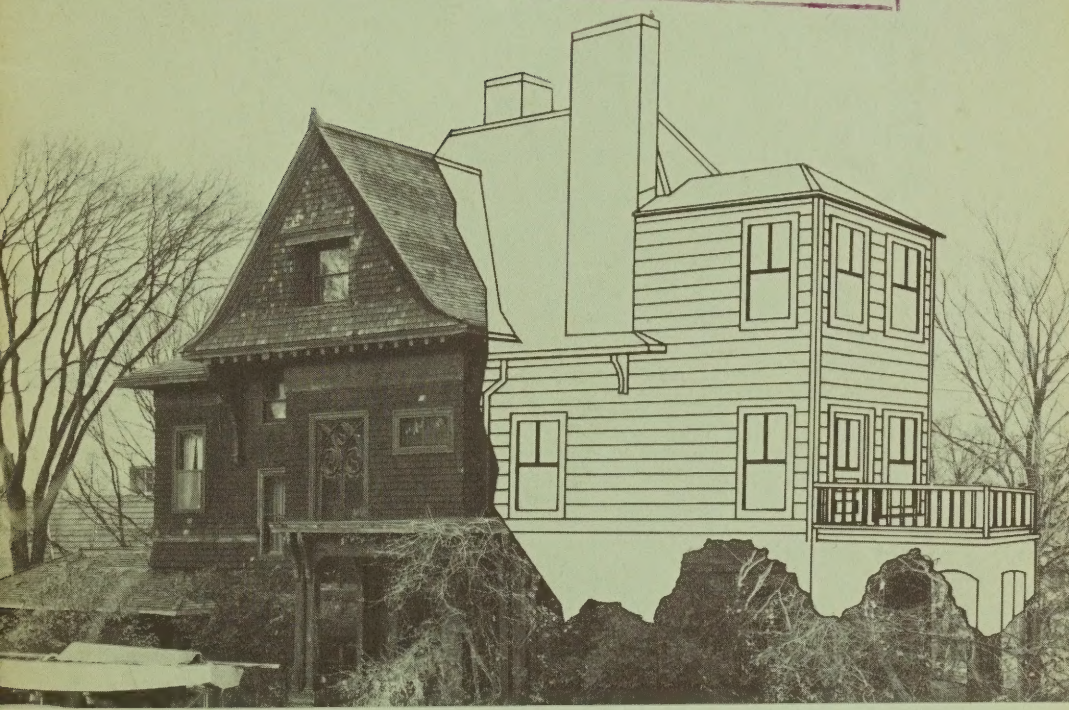
Recent Publications of the Forest Products Laboratory
Forest Service
USDA
January 1978

DIVIDENDS FROM WOOD RESEARCH



Many dividends come from wood research, but the most lasting one is research information put into practice. The first step in that sometimes lengthy path is publication of the research findings.

Here are some recent publications of the Forest Products Laboratory. Those of general interest to a broad audience are listed first. Others that are highly technical and of interest mainly to other research scientists are listed toward the rear.

If you are interested in some of these publications, please request them on the back cover of this booklet. You may be the vital link in getting the dividends of wood research into use.

Robert L. Youngs
Director, FPL

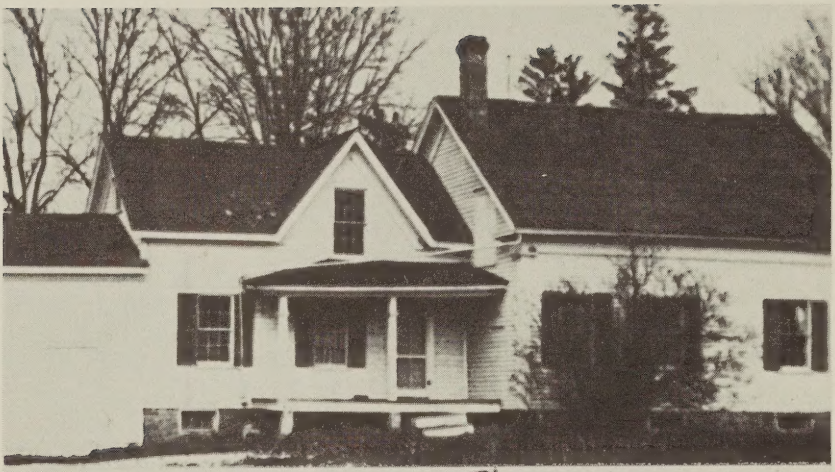
WOOD. . .

Ever-New Answer to Today's
Materials Problems:
Renewable resource
Requires low energy to process
Low pollution rate
Familiar material to handlers and users
Strong and beautiful

AND WOOD RESEARCH

is the Key
To More Efficient Use
Of This Versatile Material

HERE ARE SOME EXAMPLES OF FPL RESULTS



NEW LIFE FOR OLD DWELLINGS: APPRAISAL AND REHABILITATION

By Gerald E. Sherwood
U.S. Department of Agriculture,
Agriculture Handbook No. 481, 1975.

The wood-frame house has been one of the most prevalent forms of shelter in the United States since the days of the early settlers. As a result, throughout the country, houses of various ages, that are outmoded and deteriorated have been razed or simply abandoned. In recent years, however, there has been an upsurge in restoring houses, particularly in metropolitan areas.

Replacing a house is expensive and a drain on material resources. Restoring a house rather than replacing it has a twofold advantage of lower cost and conservation of materials. This handbook has been prepared to promote this advantage of rehabilitating an old dwelling. The principles can be applied to minor renovations.

The appraisal section of this 101-page publication provides a systematic approach for inspecting a structure and evaluating its condition. If the building is worthy, the section on rehabilitation provides detailed instructions and numerous illustrations for renovating an old house. This handbook, an 8- x 10½-inch soft-covered publication, has a glossary and index for easy use.

This book should be particularly useful to homeowners and buyers of older houses. It should interest carpenters, contractors, lending institutions, and others who seek to improve and maintain the residential dwellings of their communities.

This handbook is available for $1.70 from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

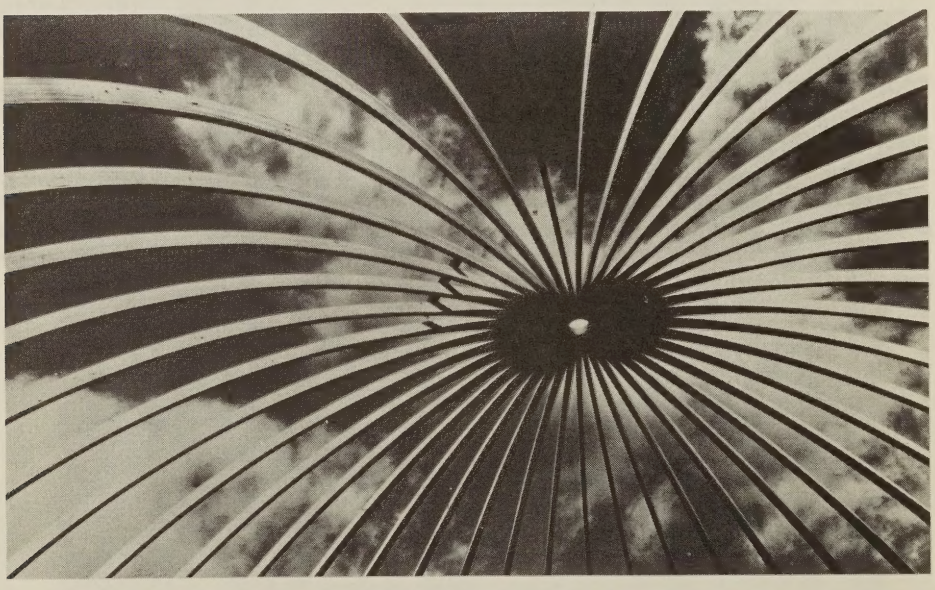
ADHESIVE BONDING OF WOOD

By M. L. Selbo
U.S. Department of Agriculture,
Technical Bulletin No. 1512, 1975.

Adhesive techniques have changed since the 1920's when FPL's Thomas Truax wrote "Gluing of Wood." Most glues were of natural materials. Synthetic glues were unknown.

Over succeeding decades, adhesives technology has mushroomed. This bulletin, a basic guide to bonding woods, describes current adhesives and dependable, long-lasting products made from them. Characteristics of wood that affect gluing are detailed, as are types of adhesives and processes for use under various conditions.

This 122-page illustrated manual, with an index and a glossary, brings together information to update Truax's tenets. This bulletin will serve as a guide to the production of more dependable glued products.



This bulletin is available for $1.55 from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

[1]

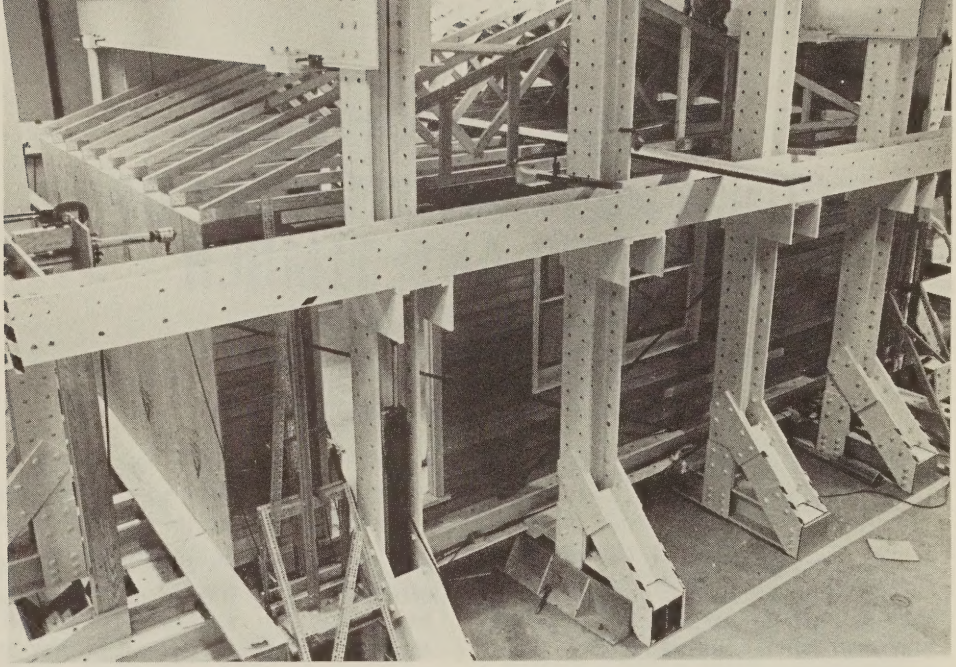
A PRAGMATIC-CONSERVATIONIST VIEW OF FORESTS AND TIMBER

By Jerome F. Saeman
Western Wildlands, Montana Forest and Conservation Exp. Sta., Univ. of Montana, Missoula 2(2):2-4, 1975.

In a guest editorial, the Deputy Director of Forest Products Laboratory posed a primary "policy" question for conservationists: Given finite resources and accelerating world demand for fuels and minerals, should the United States try to satisfy more of its industrial raw material needs with domestically produced renewable timber?

Future economic growth must come from more efficient use of raw materials rather than increased consumption of them. More efficient use of timber helps justify investment in timber production. Increased dependence on timber as a material reduces our dependence on imported minerals and energy, and shows net environmental advantages.

Dr. Saeman suggests increased relative dependence on timber as a material can help assure the "greatest good for the greatest number in the long run."



2 A CONVENTIONAL HOUSE CHALLENGES SIMULATED FORCES OF NATURE

By Roger L. Tuomi and William J. McCutcheon
Forest Products Journal 25(6):13-20, 1975.

As innovative systems are developed for housing construction, design criteria are specifying performances equal to those for a conventional house. However, the performance of a conventional house has not yet been defined.

Past work has generally been limited to the assessment of parts and pieces, but little testing has been done to evaluate the final structure as a three-dimensional unit. In this investigation the responses of conventional construction to selected imposed forces were determined. Observations recorded here suggest need for further testing of full-scale structures. Information from the testing should lead to development of more efficient structures.

3

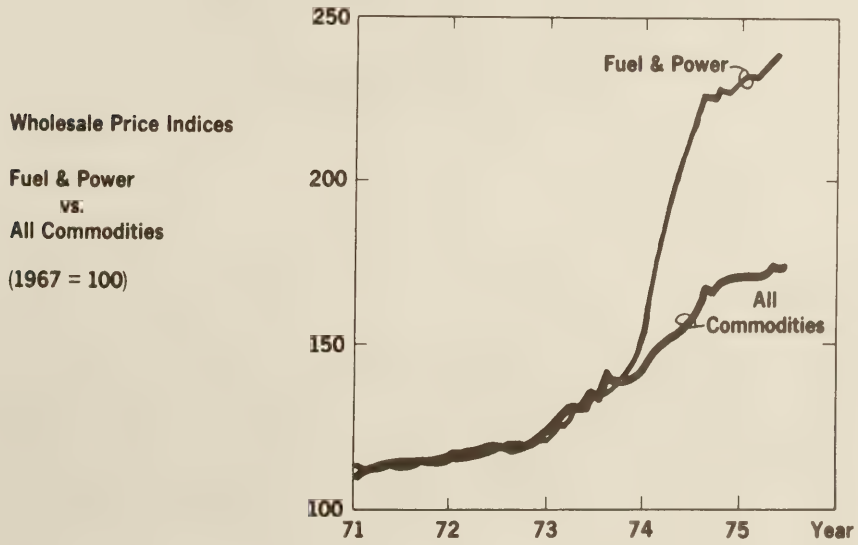
SHOULD WOOD BE A SOURCE OF COMMERCIAL POWER?

By Thomas H. Ellis
Forest Products Journal 25(10):13-16, 1975.

With skyrocketing fossil-fuel prices and problems in nuclear-power programs, it seems logical to consider the potential of wood — one of man's oldest fuels — as a primary power source for steam-electric plants.

The volume of logging and mill residues produced in 1970 had an energy potential equivalent to perhaps 10 percent of that year's fuel requirements for our Nation's steam-electric utilities. However, costs of collecting, transporting, and processing these residues in sufficient quantities for large generating plants would have been prohibitively high. Even with recent high fuel prices, residues probably are not competitive with coal for large-scale electricity generation in most areas. Because residues are increasingly attractive for use as fuels within forest industries, competition for residues is likely to rise significantly, reducing volumes potentially available for external use.

Even "energy plantations" — wood grown solely for energy production — probably would be limited by the excessively large land areas they would require in North America.



OTHER DIVIDENDS FROM WOOD RESEARCH

Single copies of all publications listed in this booklet are available free (unless designated otherwise) from the Forest Products Laboratory while the supply lasts.

To request publications simply circle the item number on the back cover of this booklet, detach the card, and mail it to the Laboratory.

Blanket requests for publications cannot be filled.

4

EFFECT OF RATE OF LOADING AND DURATION OF LOAD ON PROPERTIES OF PARTICLEBOARD

By J. Dobbin McNatt
USDA Forest Service Research Paper
FPL 270, 1975.

To use particleboards more fully as structural components, allowable design stresses must be established. Of major importance in determining these stresses are different conditions of loading.

This report, the third in a series providing basic information for writing those designs, investigates two loading conditions. Decreasing the rate of loading on four commercial particleboards and one laboratory board decreased strength, as occurs in hardboard or solid wood. Time to failure increased as stresses decreased for specimens under constant load.

5

PRODUCT AND PROCESS VARIABLES ASSOCIATED WITH A SHAPED PARTICLE BEAM

By Robert L. Geimer and William F. Lehmann
Forest Products Journal 25(9):72-80, 1975.

While the construction industry is recognizing the potential of particleboard panel products, FPL researchers are investigating particle products in other-than-panel form.

In this pilot study several innovative methods were explored of making reconstituted wood I-beams. Some beams had bending stiffness equal to or greater than that of a solid wood beam of equal weight and depth. Maximum bending strength attained was only half that of a solid rectangular beam.

Proper engineering design and construction techniques should allow fabrication of beams for specific structural applications.

6

HUMIDITY EFFECTS ON PROPERTIES OF STRUCTURAL PARTICLEBOARDS FROM FOREST RESIDUES

By J. Dobbin McNatt
USDA Forest Service Research Paper FPL 267, 1975.

As basic strength requirements for structural particleboards become known, the onsite behavior of these boards must be predictable. Exterior-grade structural particleboards must contend with extreme moisture conditions. Exterior exposure can cause loss in stiffness and changes in dimension of the board.

Three selected laboratory boards were tested on various humidity levels in bending, tension, compression, and interlaminar shear. As expected, board properties at low humidity levels were similar to those of controls; at high humidity levels, properties were only 60 to 90 percent of controls.

7 ENGINEERING PROPERTIES OF STRUCTURAL PARTICLEBOARDS FROM FOREST RESIDUES

By Robert L. Geimer, William F. Lehmann, and J. Dobbin McNatt
Proceedings of Washington State University Particleboard Symposium, pp. 119-143, 1974.

Property requirements for structural particleboards will ultimately be determined by their end use. Raw material resources for those boards will be determined by economics and by performance.

Forest residues are abundant and little used. Here 12 board types were made from residues, and tested for their basic engineering properties. Although many of the properties were closely interrelated, some panels performed more efficiently than others depending on design criteria. High-quality boards could be produced from residues with up to 8 percent bark and 12 percent decayed wood.

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8 GRAIN ANGLE THROUGH FLAKE THICKNESS: EFFECT ON PROPERTIES OF A STRUCTURAL FLAKEBOARD

By Bruce G. Heebink
USDA Forest Service Research
Paper FPL 257, 1975.

The strength and stiffness of solid wood is greatly affected by the angle of grain through the wood. This raises the question whether the grain in flakes in structural fiberboard changes strength and stiffness of the board. Ideally, a flake is cut with the wood grain parallel to its length. If flakes are cut from wood with a steep grain or are cut off-grain, as described in this paper, strength of the flakeboard is almost identical to that of solid wood with the same slope of grain.

[9] TECHNOLOGY IN THE NEW AGE OF WOOD

By Harry C. Leslie
School Shop 34(8):63-65, 1975.

In a continuing effort to use as much of each harvested tree as possible, a greatly expanded technology is developing. And with it new types of jobs are being developed.

Sonically finding defects, electronically determining the best sawing pattern, and subsequently grading the lumber will require experts with knowledge of wood, systems, and computers. Component wood products like particlebeams will require experts in adhesives, equipment, and systems design.

As the Nation takes a closer look at the potential of wood, these jobs and others like them will be the challenge for today's — and tomorrow's — students.

10

STEM ANATOMY OF 30-YEAR-OLD YELLOW-POPLAR

By A. N. Foulger, J. P. Vimmerstedt, and Cynthia Eichar
Forest Science 21(1):23-33, 1975.

Forest fertilization is a likely operation of the future, as crop-type harvesting of wood becomes more acceptable. A likely target of fertilization is yellow-poplar, one of the important hardwoods in the eastern United States and a valuable component of future forests.

This study revealed that fibers make up 76 percent and vessels about 22 percent of wood. Vessels and fiber diameter increased from the top of the tree downward and from the center outward. Site as expressed by ring width had little effect on the wood structure, implying that fertilization will have relatively minor effect on wood quality.

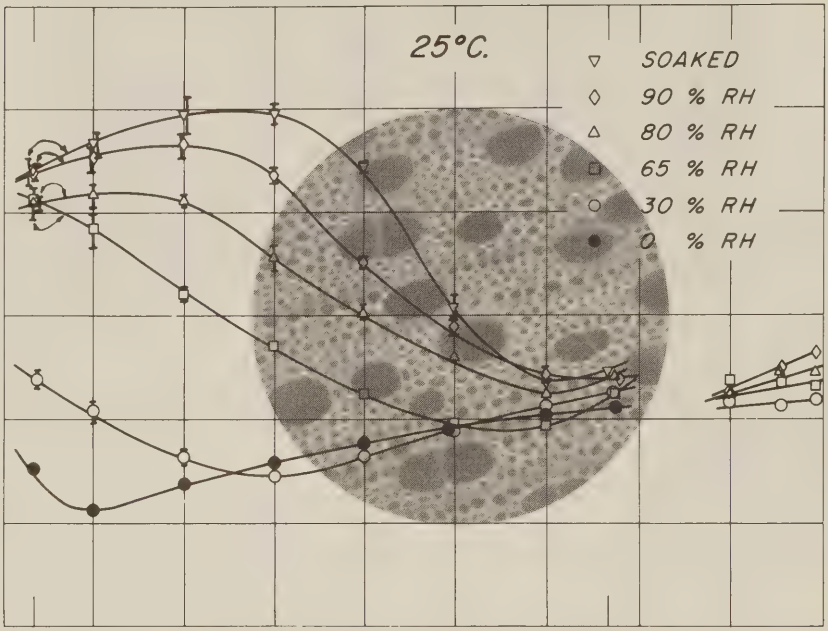
11

PEROXIDASES AS INDICATORS OF GROWTH AND DIFFERENTIATION IN ASPEN CALLUS CULTURES

By Karl E. Wolter and John C. Gordon
Physiol. Plant 33:219-223, 1975.

Trees for the forests of the future will be selected for superior characteristics such as rapid growth and desirable wood properties. To make this selection, a predictive index is needed at an early stage in genetic manipulation and progeny selection.

Enzymes such as peroxidases are potential indicators of these desired characteristics. This has been tested in a model system with tissue cultures. Growth rates and cell wall properties were manipulated by hormone treatment. The resulting changes in specific growth characteristics were then correlated with peroxidase patterns. Results showed that peroxidase enzyme activity and patterns can be used as predictive indicators of growth and cell differentiation.



12

MECHANICAL PROPERTIES OF 23 SPECIES OF EASTERN HARDWOODS

By B. Alan Bendtsen
and Robert L. Ethington
USDA Forest Service Research
Note FPL-0230, 1975.

Projected wood fiber needs emphasize the importance of developing uses for under-utilized, low-quality eastern hardwoods. A knowledge of wood properties is required to effectively utilize this resource. This paper offers a compendium of information on the mechanical properties of 23 species that provide a basis for extending their use. A method is described for the utilization of hardwoods in structural applications, even though nationally recognized allowable design stresses for them have not been developed.

13 ELECTRIC MOISTURE METERS FOR WOOD

By William L. James
USDA Forest Service General
Technical Report FPL-6, 1975.

The moisture content of wood varies widely with conditions. Because moisture content affects wood performance, the effective use of wood and wood products depends on a reliable method of assessing wood moisture. A main method involves the use of a moisture meter.

Over the years two main types of meters have been developed. They measure moisture content in terms of the electrical properties of wood, resistance, dielectric constant, and dielectric loss.

This report compiles information on meter types, and offers suggestions for efficient operation and maintenance. The paper updates information previously presented in FPL-08.

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14 DIELECTRIC PROPERTIES OF WOOD AND HARDBOARD: VARIATION WITH TEMPERATURE, FREQUENCY, MOISTURE CONTENT, AND GRAIN ORIENTATION

By William L. James
USDA Forest Service Research
Paper FPL 245, 1975.

The dielectric properties of a nonconducting material such as wood describe what happens when material is put into an electric field. The two most important interactions are the absorption and storage of energy (in the form of polarization) and the dissipation of part of that energy when the electric field is removed.

A theory is developed here for explaining dielectric constants and loss tangents. Data are presented that can satisfy most needs for designing wood or hardboard into situations involving electrical fields. This information may be used in developing and designing moisture meters.

15

PROPERTIES OF MAJOR SOUTHERN PINES: PART I - WOOD DENSITY SURVEY

By H. E. Wahlgren and D. R. Schumann

PART II - STRUCTURAL PROPERTIES AND SPECIFIC GRAVITY

By B. A. Bendtsen, R. L. Ethington, and W. L. Galligan
USDA Forest Service Research Paper FPL 176, Rev. 1975.

Forest managers have always needed to know the quantity of timber they could grow. Increasingly, the importance of the quality of the timber is being recognized to effectively utilize the wood. Wood quality is evaluated in terms of its suitability for various end uses. The specific gravity data collected in Part I are used in Part II to develop information on the mechanical properties of the species. Property information is essential to stress grading in lumber, plywood, and round timber.

This paper should be of particular interest to State, private, and Federal agencies.

16 MIDDLE ORDINATE METHOD MEASURES STIFFNESS VARIATION WITHIN PIECES OF LUMBER

By Andrew J. Kass
Forest Products Journal 25(3):33-41, 1975.

Machine stress grading of lumber utilizes the correlation between strength and stiffness. Research in improving the strength-predicting capabilities of stiffness is based upon the concept that the stiffness of the weakest region within a piece of lumber is a better indicator of strength than its overall stiffness.

A laboratory middle-ordinate measuring device was produced to measure and record deflections in short segments of lumber. The deflections, inversely proportional to the local stiffness, can be used as a strength index. In an exploratory study, minimum local MOE correlated better with compression strength than did several other measurements.

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17 FORMATION OF TYLOSES IN FELLED QUERCUS RUBRA L.

By Lidija Murmanis
Wood Science and Technology 9:3-14, 1975.

Tyloses are the product of an unusual growth process in wood that in some species takes place after a tree has been cut down. Where tyloses occur, hardwoods are difficult to treat. Thus far, research on this formation has been limited to describing structural and developmental features.

Tyloses form within hours in red oak if the tree is felled during the active growth season. If the wood is cut during a dormant period, tyloses form after months of storage. Understanding tyloses formation will allow for more effective treatment of lumber.

18 COMPARISON OF DUAL LINEAR AND DOT-GRID EYEPIECE METHODS FOR ESTIMATING WOOD PROPERTIES OF DOUGLAS-FIR

By J. Thomas Quirk and Diana Smith
Wood Science 8(2):92-96, 1975

In any study of wood anatomy, tissue type proportions or anatomical parameters can be determined in a number of ways. The two rigid and efficient techniques described here can accurately estimate cross-sectional area and cell wall specific gravity for studies related to pulping, gluing, permeability, and strength.

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19 DOT GRID INTEGRATING EYEPIECE: TWO SAMPLING TECHNIQUES FOR ESTIMATING CELL WALL AREAS

By J. Thomas Quirk
Wood Science 8(2):88-91, 1975.

The integrating eyepiece optically superimposes a dot-grid onto an intact wood specimen. By passing the eyepiece across the specimen in random passes, or by picking random fields from within certain boundaries, cell wall area and specific gravities can be precisely estimated. For the same degree of accuracy the pass method was more efficient for earlywood, the field method for latewood.

20

IN-PLACE TREATMENT OF SIMULATED WATERFRONT STRUCTURES FOR DECAY CONTROL

By Terry L. Highley and Theodore C. Scheffer
Material und Organismen
10(1):57-66, 1975.

Many old dockside structures have never been treated or have been poorly treated with preservatives. In cooperation with the Navy, the authors attempted to find whether superficial in-place application of fungicides could extend the service lives of wood members in these environments.

Simulated deck sections and pile tops were exposed in Mississippi — on land — and treated with a variety of chemicals and schedules. In 5 years, degree of decay of deck parts ranged from substantial (pine) to not visible (Douglas-fir heartwood). Future inspections are expected to provide additional information. Simple treatment of cutoff pile tops added substantially to the service life of piles.

21 SERVICE RECORDS ON TREATED AND UNTREATED FENCEPOSTS

By Lee R. Gjovik and Harley L. Davidson
USDA Forest Service Research Note
FPL-068, Rev. 1975.

The search for efficient, safe wood preservatives has been continuous. In 1908 the Forest Service treated test fenceposts with a small number of preservatives, and installed them at various plots throughout the Nation. Forest Products Laboratory soon after its beginnings, took over the testing, adding more fenceposts in a variety of species and testing additional preservatives until their total has now reached 74.

Posts are convenient to measure effectiveness of a wide variety of preservatives, treatments, and wood species in various climates. Actual or estimated service lives are reported for installations in which 10 percent or more of the posts have failed.

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22 COMPARISON OF WOOD PRESERVATIVES IN STAKE TESTS (1975 Progress Report)

By L. R. Gjovik and H. L. Davidson
USDA Forest Service Research Note
FPL-02, 1975.

Preservative-treated wood stakes, placed in selected sites around the United States, are a quick, efficient means of testing and comparing treatments. At various times since 1938, the U.S. Forest Products Laboratory has installed treated stakes in Wisconsin, Louisiana, Mississippi, Florida, and Panama. At the Mississippi site, stakes of plywood, modified woods, and laminated paper plastic have been included. Because of their small size (2- x 4- x 18-in.), the stakes are rapidly affected by exposure to decay and termites.

This latest progress report lists all the preservatives used, all the stake types, and the length of service for all of the combinations of preservatives.

23 COMPARISON OF WOOD PRESERVATIVES IN MISSISSIPPI POST STUDY (1975 Progress Report)

By L. R. Gjovik and H. L. Davidson
USDA Forest Service Research
Note FPL-01, 1975.

In Saucier, Miss., treated southern pine fenceposts have been studied for almost 40 years to evaluate the effectiveness of various wood preservatives. Since the first installation in 1936, posts treated with 70 different preservatives or combinations of them, and untreated control posts have been exposed to decay; the last posts were added in 1964.

Some treatments failed completely; some indicate estimated service lives of 38 years. This progress report describes a number of the treatments, their exposure conditions, and their service records.

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24 HOW NINE INORGANIC SALTS AFFECTED SMOKE YIELD FROM DOUGLAS-FIR PLYWOOD

By John J. Brenden
USDA Forest Service Research Paper
FPL 249, 1975.

Fire retardants have been considered principally for their ability to reduce the spread of fire. Now retardants are being examined for their ability to reduce smoke production. Smoke can prevent escape from a burning building; firefighting can be hampered.

Douglas-fir plywood specimens treated with nine chemicals, some of them components of fire retardants, were tested in flaming and nonflaming exposures. Sodium dichromate reduced smoke yield under both conditions. Many of the other eight reduced smoke under nonflaming exposures.

25 WOOD-BASE BUILDING MATERIALS: RATE OF HEAT RELEASE

By John J. Brenden
Journal of Fire and Flammability
6(3):274-293, 1975.

The definition of "combustibility" has been a problem in writing and using fire codes. The National Bureau of Standards suggested recently that combustibility be defined in terms of heat release. Determining the rate of heat release may be the best measure. Plywood, hardboard, lumber, and other materials — treated and untreated — were exposed to fire in a special furnace. Fire-retardant treatments greatly reduced maximum rate of heat release.

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26 FIRE ENDURANCE OF WOOD-FRAME AND SANDWICH WALL PANELS

By H. W. Eickner
Journal of Fire and Flammability
6(2):155-190, 1975.

Houses of conventional wood-frame construction usually show adequate fire endurance, but new construction systems being used may have less fire endurance. One of these systems is structural sandwich assemblies with high-strength facings bonded to low-density cores.

Nine sandwich and five wood-stud 8- by 10-foot wall sections were loaded with 1,250 pounds per lineal foot and exposed to fire in a laboratory vertical furnace. Stud walls endured for about 30 minutes and sandwich panels about 4 minutes. With gypsum board layers, the sandwich panels gained about 20 additional minutes of resistance to fire under loading.

27

HIGH-CONCENTRATION ALKALI PULPING OF SOUTHERN PINE

By W. J. Connors and N. Sanyer
Tappi 58(2):80-82, 1975.

The unmistakable, pervading odor of sulfur around a kraft papermill may be eliminated. An alternative to the sulfur pulping process may be a process in which high concentrations of alkali are used.

Pulps prepared with 14N potassium hydroxide gave higher yields than did kraft pulps. The KOH pulps were strong but bulky, and handsheets made from them could not be densified to a typical level of kraft pulps. These pulps have potential for use in absorbent tissues and toweling.

28 EFFECT OF ANAEROBIC STORAGE UPON QUALITY OF ASPEN PULPWOOD CHIPS

By Wallace E. Eslyn and James F. Laundrie
Tappi 58(6): 109-110, 1975.

Paper companies store pulpwood in the form of chips, and storage conditions are conducive to growth of fungi that cause chip degrade. In this study, changes were measured in softwood chips stored in the absence of air. The increasing use of hardwoods in pulp and paper production encourages the application of those studies to aspen chips, which are more readily biodegradable.

Specific gravities of chips changed only slightly after even as much as 26 months' storage in an oxygen-free gaseous atmosphere. Losses were more significant for water-stored chips. Both values, however, were lower than those for a softwood stored in the same way. Properties of handsheets made from these chips also showed only slight changes.

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29 STORAGE OF RED ALDER CHIPS WITH AND WITHOUT BARK — TREATED AND UNTREATED

By E. L. Springer, F. L. Schmidt,
W. C. Feist, L. L. Zoch, Jr.,
and G. J. Hajny
USDA Forest Service Research Paper
FPL 261, 1975.

Pulping wood with its bark on was unthinkable just a few years ago. An abundance of clean chip resources made wood with bark seem less than desirable. Today, pulp producers are beginning, on a commercial basis, to mix some roughwood (wood with bark on) with clean chips. Because more living cambial cells were present in the roughwood than in the clean chips, there was the possibility of enhanced chip deterioration during storage.

Roughwood and clean red alder chips were stored for 6 months in simulated piles with only minor differences in their storage characteristics.

30 HIGH-YIELD LINERBOARD KRAFT PULP FROM ROUGHWOOD CHIPS

By Richard A. Horn
Tappi 58(9):142-145, 1975.

Renewed interest in more efficient wood utilization has led to studies that show the feasibility of producing kraft pulp from barky chips.

Specific data are presented here comparing handsheet properties of pulp produced from roughwood and from clean chips. Eliminating whitewood losses made higher yields possible, and a centricleaning system reduced all dirt levels and increased pulp strength. Strength effects from both yield and centricleaning were species dependent.

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31 WHAT ARE THE EFFECTS OF RECYCLING ON FIBER AND PAPER PROPERTIES?

By Richard A. Horn
Paper Trade Journal 159(7/8):78-82, 1975.

Recycled paper does not have qualities equal to those of virgin paper. Fibers change drastically during repulping. But exactly what the changes are and how they ultimately affect the paper has not been known.

To study this, a method was developed of making handsheets that more closely simulated commercial conditions. Measurements on handsheets from the process showed that, if strength is most important, loss in fiber bonding is the most critical factor in recycling pulp fiber. Results showed that losses in sheet strength due to rosin size could be negated by treating the recycled fiber with dilute alkali.

32 WASTE NEWSPAPERS CAN BE FIBER SOURCE FOR CORRUGATING MEDIUM

By John W. Koning, Jr.
Paper Trade Journal 159(16):63, 1975.

Old newspapers have many uses; now they may have one more use. Corrugating medium, the fluted middle layer of a piece of fiberboard, can be made partly from recycled newsprint. Because many communities now collect newspapers separate from other trash, the papers are virtually free of many contaminants. The medium made with newspapers can be fluted and bonded at regular commercial speeds.

A mixture of 35 percent newspaper and 65 percent commerical neutral sulfite semi-chemical pulp, with 2-1/2 percent starch added, was equal in strength, except in tension, to a 100 percent neutral sulfite semichemical pulp.

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33 REPEATED RECYCLING OF CORRUGATED CONTAINERS AND ITS EFFECT ON STRENGTH PROPERTIES

By J. W. Koning, Jr. and W. D. Godshall
Tappi 58(9):146-150, 1975.

Fibers from corrugated containers are of high quality and are abundant in concentrated commercial areas. Use of this fiber could be extended if the effects of repeated recycling on the strength properties of containers made from this fiber were known. In this study these effects were investigated.

In general, container strength and performance were lowered when 100 percent recycled fiber was used. The greatest loss in strength occurred between the virgin material and the first recycle, rather than between subsequent recycles.

34 SECONDARY FIBER RESEARCH AT THE FOREST PRODUCTS LABORATORY

By J. H. Klungness
Tappi 58(10):128-131, 1975.

To fully utilize available pulp fiber and to lower papermaking equipment costs, the Forest Products Laboratory has examined numerous forms and combinations of wastepapers, sources of secondary fibers. The author reviews research aimed at eliminating technical obstacles to increased use of secondary fibers.

Recent research has focused on new sources of fiber, outlets for possible products, contaminant-removal processes, and various factors that affect pulp properties. Additional research must be aimed at removing plastics from pulp and reducing fiber-bonding losses due to recycling.

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35 METHOD FOR MEASURING THE INTERLAMINAR SHEAR PROPERTIES OF PAPER

By Von L. Byrd, Vance C. Setterholm, and John F. Wichmann
Tappi 58(10):132-135, 1975.

Paper is made up of many thin layers of fibers. When paper is stressed during use, the layers tend to peel apart. This interlaminar shear is one of the weakest links in paper structure.

This report is part of a study to relate shear to total paper performance. This test apparatus is described for developing a reliable method of measuring interlaminar shear stress-strain.

36 CHEMISTRY OF LIGNIN DEGRADATION BY WOOD DESTROYING FUNGI

By T. Kent Kirk

In: Biological Transformation of Wood by Microorganisms. Proceedings of the Sessions on Wood Products Pathology at the 2d International Congress of Plant Pathology, pp. 153-164, 1973.

In this paper findings by the U.S. Forest Products Laboratory on the chemistry of the degradation of lignin by fungi are summarized. Although the gross chemistry of degradation is understood, the detailed chemistry is not. Virtually nothing is known about the biochemistry. Both the chemistry and the biochemistry of lignin degradation are under investigation at the Forest Products Laboratory.

37 INHIBITION OF CELLULASES OF WOOD-DECAY FUNGI

By Terry L. Highley
USDA Forest Service Research
Paper FPL 247, 1975.

Wood-rotting fungi produce cellulases, enzymes that break down cellulose in wood. To prevent this breakdown, the cellulases can be inhibited by certain treatments. Cellulase inhibitors have potential to be used commercially to improve wood preservatives or in research to control enzyme action so that the action can be further studied.

The cellulase enzymes from two brown-rot and two white-rot fungi differed in their reaction to inhibitors. The enzymes from the white-rot fungi were affected more and by a greater variety of inhibitors, including classical inhibitors, phenolics, and wood extracts, than were the brown-rot fungi.

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38 TOPOCHEMISTRY OF THE FUNGAL DEGRADATION OF LIGNIN IN BIRCH WOOD AS RELATED TO THE DISTRIBUTION OF GUAIACYL AND SYRINGYL LIGNINS

By T. Kent Kirk, Hou-min Chang, and L. F. Lorenz
Wood Science and Technology 9(2):81-86, 1975.

White-rot fungi degrade all the structural components of wood progressively. As hyphae enter the cells, the fungi begin a surface attack on the most available lignin, and work their way through the cells toward the middle lamella. Results of this study indicated that, according to the microstructural distribution of lignins, fungi degrade syringyl-rich lignin first and then guaiacyl-rich lignin. This provides biological evidence for the differences in the distributions of the two lignins within wood cells.

39

CAN WOOD-ROT FUNGI DEGRADE CELLULOSE WITHOUT OTHER WOOD CONSTITUENTS?

By Terry L. Highley
Forest Products Journal 25(7):38-39, 1975.

To better understand the behavior of wood-rotting fungi, representative brown- and white-rot fungi were studied for their ability to degrade cellulose separately from other wood constituents.

On filter papers that provided cellulose as the sole carbon source, brown-rot fungi grew only slightly, whereas white-rot grew abundantly. This suggests that some sort of inducer in wood, not present in cellulose, permits brown-rots to degrade cellulose.

40

CHANGES IN THE CHEMICAL COMPOSITION OF WOOD CAUSED BY SIX SOFT-ROT FUNGI

By W. E. Eslyn, T. K. Kirk, and M. F. Effland
Phytopathology 65(4):473-476, 1975.

Of the major wood decay fungi — white-, brown-, and soft-rot — the least studied are the soft-rot. Soft-rot fungi are found extensively in pulp chips in storage piles where they cause severe losses in wood substance. The chemical effects of only one soft-rot fungus on only one wood species, European beech, have been investigated.

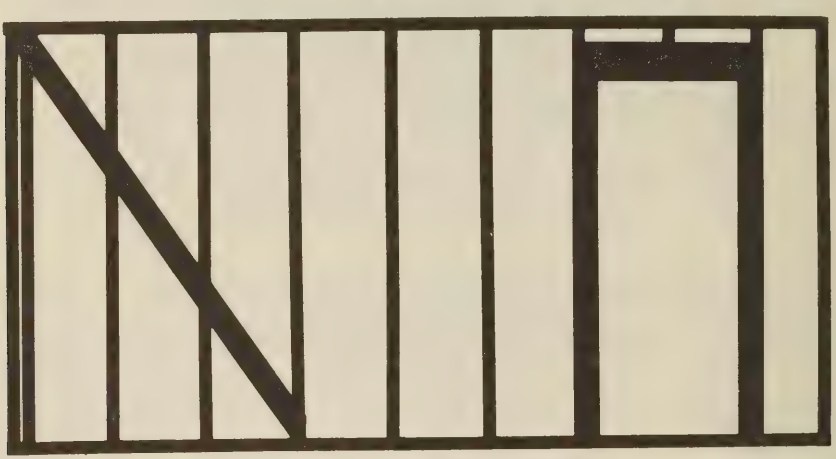
This study enlarges soft-rot knowledge by assessing the chemical changes effected by six other soft-rots on three species, red alder, balsam poplar, and western white pine.

41

GUM GUAIAC IN FIELD TESTS FOR EXTRACELLULAR PHENOL OXIDASES OF WOOD-ROTTING FUNGI AND OTHER BASIDIOMYCETES

By Robert L. Gilbertson, Frances F. Lombard, and Elmer R. Canfield
USDA Forest Service Research Paper FPL 269, 1975.

The gum guaiac test is a simple procedure for quickly determining the presence of phenol oxidases in wood-rotting fungi. The response of fungi in the test is one of the most useful criteria in their correct identification. This paper catalogs the reactions of 192 correctly identified Basidiomycetes, and will be a guide in identifying these species in future research.



42 EFFECTS OF FLANKING AND TEST ENVIRONMENT ON LAB-FIELD CORRELATIONS OF AIRBORNE SOUND INSULATION

By Robert E. Jones
Journal of the Acoustical Society of America 57(5):1138-1149, 1975.

Architects and builders design apartments for many attributes, including a prediction of the sound-insulated performance of walls from laboratory data. However, laboratory tests for sound insulation are not yet well correlated with field data from actual apartments.

This study has improved quantification of the differences between lab and field performances as they relate to flanking (sound transmission by paths other than directly through a test partition) and test environment (room geometry and furnishings) factors. Results suggest that partitions be evaluated under a range of field and simulated field conditions to develop and characterize party partitions.

43 SURFACE DAMAGE BEFORE GLUING—WEAK JOINTS

By Bryan H. River and Victor P. Miniutti
Wood and Wood Products 80(7):35-36, 38, 1975.

A furniture parts manufacturer recently noted he was producing weak joints when he edge-glued sawn surfaces of yellow-poplar. In this article an adhesives technologist and a microscopist discuss the likely reasons for these low strength joints.

The scientists found that wood damage during machining caused crushed cells which were directly responsible for weak joints. These joints, if broken, expose a fibrous, or granular, surface. By contrast, joints between smooth surfaces should break along the grain. The article enumerates factors which can affect the quality of machined surfaces.

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44 INVESTIGATING METHODS TO EVALUATE IMPACT BEHAVIOR OF SHEATHING MATERIALS

By Michael J. Superfesky
USDA Forest Service Research Paper
FPL 260, 1975.

Sheathing materials are used in walls, roofs, and floors of buildings. Sheathing is subject to impact damage from objects and from people striking it.

No standards exist for determining sheathing impact resistance because sheathing behavior depends on several complex factors. The procedures suggested in this paper will eliminate variability introduced by framing members and provide a meaningful method of evaluation.

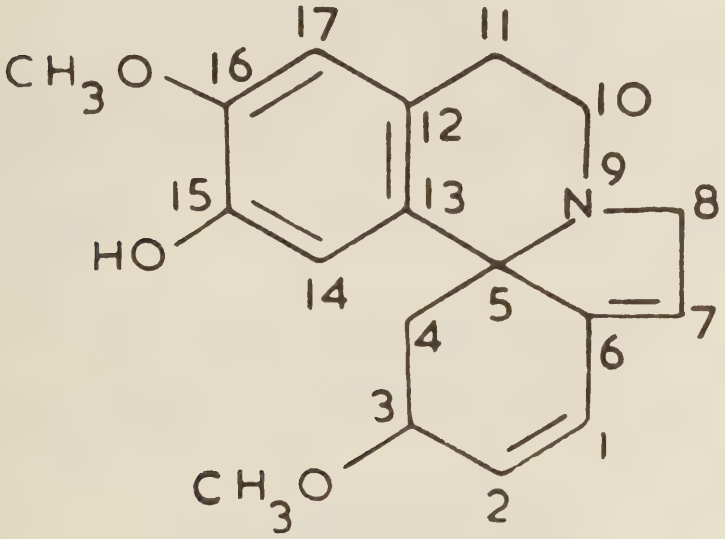
45 DURABILITY OF ADHESIVES IN PLYWOOD: DRY-HEAT EFFECTS BY RATE-PROCESS ANALYSIS

By Robert H. Gillespie and Bryan H. River
Forest Products Journal 25(7):26-32, 1975.

New adhesives often are not accepted on the market because their service lives are unknown. To estimate service life, a rate-process technique is being developed. The technique is being tested in laboratory accelerated-aging tests on bonded joints in water-soak conditions or dry-heat conditions.

In dry-heat aging tests at the U.S. Forest Products Laboratory, joint bonds degraded in recognized patterns. Dry-heat aging showed a rapid initial strength loss with increased acidity at the bond line. Results indicate that aging with rate-process techniques of analysis can be a sensitive method of predicting long-term performance.

HIGHLY TECHNICAL



Anatomical

46 EXTRACTIVES PRODUCED DURING HEARTWOOD FORMATION IN RELATION TO AMOUNTS OF PARENCHYMA IN *JUGLANS NIGRA* AND *QUERCUS RUBRA*

By Neil D. Nelson
Canadian Journal of Forest Research
5(2):291-301, 1975.

Because black walnut and red oak are economically important species, the formation of their heartwood is of interest to geneticists who wish to improve the supply of these species. The formation of heartwood is characterized by the production of phenolic extractives in the heartwood-sapwood transition zone.

This study tested the theory that relative amounts of parenchyma in the transition zone influence extractives activity. Data suggest, however, that heartwood formation is more affected by physiological conditions near the transition zone than by amounts of parenchyma.

Biological

47 **EFFECTS OF A BROWN-ROT FUNGUS, *LENZITES TRABEA*, ON LIGNIN IN SPRUCE WOOD**

By T. Kent Kirk
Holzforschung 29(3):99-107, 1975.

Brown-rot fungi are the Nation's most economically important wood-destroying organisms. They destroy the wood carbohydrates, and leave a brown residue of modified lignin. In this investigation, chemical changes in the lignin are defined. Surprisingly, results suggest that brown-rot fungi may one day be useful in bioconverting waste lignins to useful chemicals.

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48 **DISSIMILATION BY THE LIGNIN MODEL COMPOUND VERATRYLGLYCEROL-β-(o-Methoxyphenyl) ETHER BY *PSEUDOMONAS ACIDOVORANS*: INITIAL TRANSFORMATIONS**

By R. L. Crawford, T. Kent Kirk, and Elizabeth McCoy
Canadian Journal of Microbiology 21:577-579, 1975.

The chemical reactions comprising the bacterial degradation of the lignin-related compound are described. This work provided information on the kinds of reactions bacteria are capable of carrying out in lignin. This knowledge is important in efforts to use bacteria in biologically converting waste lignin to usable products.

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49 **DECOMPOSITION OF LIGNIN BY WHITE-ROT FUNGI II. CHARACTERIZATION OF HEAVILY DEGRADED LIGNINS FROM DECAYED SPRUCE**

By T. Kent Kirk and Hou-min Chang
Holzforschung 29(2):56-64, 1975.

White-rot fungi are probably the major organisms responsible for cycling the carbon of lignin in nature. They also are serious destroyers of wood products and, conversely, are very attractive as agents for the beneficial bioconversion of wood. Understanding these degradative changes is fundamental to development of improved decay controls and to progress in wood bioconversion.

50 PREPARATION AND MICROBIAL DECOMPOSITION OF SYNTHETIC (^{14}C) LIGNINS

By T. K. Kirk, W. J. Connors, R. D. Bleam, W. F. Hackett, and J. G. Zeikus
Proceedings of the National Academy of Sciences 72(7):2515-2519, 1975.

In the biodegradation of wood, white-rot fungi must break down lignin to gain access to the cellulose. Until now there has been no method of accurately measuring lignin degradation so the process could be definitively studied. Using a synthetic lignin made with radioactive carbon atoms, the authors have developed an accurate quantitative and qualitative assay for lignin degradation.

This assay will allow many more problems to be solved in the biological decomposition of wood.

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51 *PENIOPHORA TAMARICICOLA* IN NORTH AMERICA

By Robert L. Gilbertson and Harold H. Burdsall, Jr.
Mycotaxon 2(1):143-150, 1975.

Field work in Arizona over the last 5 years has revealed the presence of a fungus not known to occur in North America. The fungus, Peniophora tamaricicola, was described originally as common in Morocco. In the United States the species is found on dead branches of mesquite and other desert shrubs. Characteristics of cultures and basidiocarps are described.

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52 TAXONOMY OF *CORTICIUM CHRYSOCREAS* AND *PHLEBIA LIVIDA*

By Frances F. Lombard, Harold H. Burdsall, Jr., and Robert L. Gilbertson
Mycologia LXVII(3):495-510, 1975.

Since the late 1920's, a fungus causing heart-rot in hardwoods in southern, eastern, and central United States has been encountered in decay surveys by the U.S. Department of Agriculture. Readily recognized by its distinctive yellow color, the fungus was not identified until some cultures were matched to a correctly identified basidiocarp of Corticium chrysocreas. This article corrects the nomenclature of the fungus and describes and illustrates its basidiocarps and cultures.

53 **NOTES ON WOOD-ROTTING HYMENOMYCETES IN NEW MEXICO**

By R. L. Gilbertson,
H. H. Burdsall, Jr.,
and M. J. Larsen

Southwestern Naturalist 19(4):347-360, 1975.

In 1967, 1968, and 1972, the authors collected 190 species of wood-rotting Basiciomycetes in New Mexico in primarily coniferous forest zones. This article includes substrate relationships, types of rot, other ecological data, and unusual characteristics.

Chemical

54 ***ENT*-16-KAUREN-19-01 FROM COFFEE**

By Inger Wahlberg, Curt R. Enzell, and John W. Rowe
Phytochemistry 14(7):1677, 1975.

The title compound was isolated during a study of the sterols found in angiosperms. The structure of this diterpene, which was reported previously, has been determined.

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55 **INVESTIGATION OF *ERYTHRINA* SPP. VII. CHEMICAL CONSTITUENTS OF *ERYTHRINA VARIEGATA* VAR. *ORIENTALIS* BARK**

By Harkishan Singh, Amrik Singh Chawla, A. K. Jindal, Anthony H. Conner, and John W. Rowe
Lloydia, Journal of Natural Products 38(2):97-100, 1975.

This bark, long used as a drug in India, has been analyzed in a cooperative study between chemists of India and the United States. Two pharmaceutically active alkaloids have been isolated in addition to wax alcohols and acids, alkyl ferulates and related compounds, and several steroids.

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56 **NEUTRALS IN SOUTHERN PINE TALL OIL**

By A. H. Conner and J. W. Rowe
Journal of the American Oil Chemists' Society 52(9):334-338, 1975.

Black-liquor soap skimmings from southern pine kraft pulp contain 5 to 10 percent neutral components that have no commercial value and cause losses or contamination of the fatty acid and resin acid fractions. Increased information on the neutrals could lead to new products and improved utilization of the fatty and resin acids in tall oil.

All neutral components in a pooled sample of soap skimmings present at the 0.1 percent level or higher were identified — a total of more than 80 compounds.

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